CLAIMS

1. A method of manufacturing an image display panel used for an image display device, in which liquid powders composed of a solid material stably floating as a dispersoid in a gas and exhibiting a high fluidity in an aerosol state or particles are sealed in a plurality of cells formed by partition walls between opposed substrates, at least one substrate being transparent, and, in which the liquid powders or the particles, to which an electrostatic field is applied from two kinds of electrodes having different potentials, are made to fly and move so as to display an image, characterized in that, in a method of manufacturing the image display panel, in which the liquid powders or the particles are sealed in the cells between the substrates by filling and setting the liquid powders or the particles on the substrate to which the partition walls are arranged and then by stacking another substrate thereon, the improvement further comprises, in the case of filling and setting the liquid powders or the particles in a plurality of cells formed by the partition walls on the substrate, the steps of:

setting a nozzle at an upper portion of a container;

setting the substrate, on which the partition walls are arranged, at a lower portion of the container;

scattering the liquid powders or the particles dispersed in a gas from the nozzle arranged at the upper portion in the container; and

filling the liquid powders or the particles in the cells on the substrate arranged at the lower portion in the container.

2. The method of manufacturing the image display panel according to claim 1, wherein, in the case of filling two or more kinds of the liquid powders or the particles having different colors and different characteristics, the improvement further comprises the steps of:

filling first liquid powders or first particles in the cells on the substrate by scattering the first liquid powders or the first particles dispersed in the gas from the nozzle arranged at the upper portion in the container to the substrate set at the lower portion in the container;

filling continuously second liquid powders or second particles in the cells, in which the first liquid powders or the first particles are filled previously, on the substrate by scattering the second liquid powders or the second particles dispersed in the gas from the nozzle arranged at the upper portion in the container to the substrate having the cells, in which the first liquid powders or the second particles are filled, arranged at the lower portion in the container; and

repeating the above filling steps so as to fill all kinds of the liquid powders or the particles in the cells.

3. The method of manufacturing the image display panel according to claim 1 or 2, wherein the scattered liquid powders or the scattered particles remaining on a top of the partition walls are removed by rolling a removing roller on the substrate, after filling and setting the liquid powders or the particles on the substrate to which the partition walls are arranged and before stacking another substrate thereon.

4. The method of manufacturing the image display panel according to claim 3, wherein the removing roller has conductivity and is grounded when it is rolled on the substrate.

5. The method of manufacturing the image display panel according to claim 3 or 4, wherein a circumferential length of the removing roller is longer than a length of the substrate from which the liquid powders or the particles are removed.

6. The method of manufacturing the image display panel according to one of claims 3 - 5, wherein JIS-A hardness of the removing roller is in a range of 40 - 90 degrees.

7. The method of manufacturing the image display panel according to one of claims 3 - 6, wherein a construction material of the removing roller has a volume specific resistance of less than 1×10^{11} $\Omega\cdot$cm.

8. The method of manufacturing the image display panel according to one of claims 1 - 7, wherein the partition walls are arranged on one of or both of the substrates.

9. The method of manufacturing the image display panel according to one of claims 3 - 8, wherein the step of removing the scattered liquid powders or the scattered particles remaining on the top of the partition walls by rolling the removing roller on the substrate is performed at every times after scattering the liquid powders or the particles to be filled in the cells on the substrate.

10. The method of manufacturing the image display panel according to one of claims 3 - 8, wherein the step of removing the scattered liquid powders or the scattered particles remaining on the top of the partition walls by rolling the removing roller on the substrate is performed after scattering all the liquid powders or all the particles to be filled in the cells on the substrate.

11. The method of manufacturing the image display panel according to one of claims 1 - 10, wherein the step of scattering the liquid powders or the particles is prepared continuously by the number of the kinds of liquid powders or the kinds of particles corresponding to the kinds of liquid powders or the kinds of particles.

12. The method of manufacturing the image display panel according to one of claims 1 - 11, wherein a particle component constituting the liquid powders has an average particle diameter of 0.1 - 20 μm.

13. The method of manufacturing the image display panel according to one of claims 1 - 12, wherein a particle component constituting the liquid powders has a surface charge density of 5 - 150 $\mu C/m^2$ in an absolute value.

14. The method of manufacturing the image display panel according to one of claims 1 - 13, wherein the liquid powders filled between the substrates have a volume occupying rate of 5 - 70 vol%.

15. The method of manufacturing the image display panel according to one of claims 1 - 11, wherein an average particle diameter of the particles is 0.1 - 50 μm.

16. The method of manufacturing the image display panel according to one of claims 1 - 11 and 15, wherein a surface charge

density of the particles is 5 - 150 $\mu C/m^2$ in an absolute value.

17. The method of manufacturing the image display panel according to one of claims 1 - 11 and 15 - 16, wherein the particles filled between the substrates have a volume occupying rate of 5 - 70 vol%.

18. An image display device characterized in that the improvement installs the image display panel manufactured according to the method of manufacturing the image display panel set forth in one of claims 1 - 17.

19. A method of manufacturing an image display device which comprises an image display panel having one or more image display cells isolated each other by partition walls, in which two kinds of liquid powders composed of a solid material stably floating as a dispersoid in a gas and exhibiting a high fluidity in an aerosol state, having a pale bright color (e.g. white color) and a deep dark color (e.g. black color) and having different charge characteristics, or, two kinds of particles having a pale bright color (e.g. white color) and a deep dark color (e.g. black color) and having different charge characteristics, are sealed between a transparent substrate and an opposed substrate, and, in which the liquid powders or the particles, to which an electrostatic field produced by a pair of electrodes having different potentials is applied, are made to fly and move so as to display a monotone image, characterized in that the improvement further comprises:

a filling step for filling a predetermined amount of the liquid powders or the particles in spaces constituting the image display cells isolated by the partition walls;

a removing step for removing unnecessary liquid powders or unnecessary particles remaining on the partition walls in the filling step;

a substrate stacking step for stacking the transparent substrate and the opposed substrate via the partition walls and applying a sealing agent at a peripheral portion of the substrate so as to make an

atmosphere between the transparent substrate and the opposed substrate uniform; and

an electrode adhering step for connecting a circuit for displaying the image to the electrode so as to form a module.

20. A method of manufacturing an image display device which comprises an image display panel having one or more image display cells isolated each other by partition walls, in which two kinds of liquid powders composed of a solid material stably floating as a dispersoid in a gas and exhibiting a high fluidity in an aerosol state, having a predetermined color other than white color and a black color and having different charge characteristics, or, two kinds of particles having a predetermined color other than white color and a black color and having different charge characteristics, are sealed between a transparent substrate and an opposed substrate, and, in which the liquid powders or the particles, to which an electrostatic field produced by a pair of electrodes having different potentials is applied, are made to fly and move so as to display a color image, characterized in that the improvement further comprises:

a filling step for filling a predetermined amount of the liquid powders or the particles in spaces constituting the image display cells isolated by the partition walls;

a removing step for removing unnecessary liquid powders or unnecessary particles remaining on the partition walls in the filling step;

a substrate stacking step for stacking the transparent substrate and the opposed substrate via the partition walls and applying a sealing agent at a peripheral portion of the substrate so as to make an atmosphere between the transparent substrate and the opposed substrate uniform; and

an electrode adhering step for connecting a circuit for displaying the image to the electrode so as to form a module.

21. A method of manufacturing an image display device which comprises an image display panel having one or more image display

cells isolated each other by partition walls, in which two kinds of liquid powders composed of a solid material stably floating as a dispersoid in a gas and exhibiting a high fluidity in an aerosol state, having a white color and a black color and having different charge characteristics, or, two kinds of particles having a white color and a black color and having different charge characteristics, are sealed between a transparent substrate and an opposed substrate, and, in which the liquid powders or the particles, to which an electrostatic field produced by a pair of electrodes having different potentials is applied, are made to fly and move so as to display a color image via a color filter provided to the transparent substrate constituting a front panel, characterized in that the improvement further comprises:

a filling step for filling a predetermined amount of the liquid powders or the particles in spaces constituting the image display cells isolated by the partition walls;

a removing step for removing unnecessary liquid powders or unnecessary particles remaining on the partition walls in the filling step;

a substrate stacking step for stacking the transparent substrate and the opposed substrate via the partition walls and applying a sealing agent at a peripheral portion of the substrate so as to make an atmosphere between the transparent substrate and the opposed substrate uniform; and

an electrode adhering step for connecting a circuit for displaying the image to the electrode so as to form a module.

22. The method of manufacturing the image display device according to one of claims 19 - 21, wherein an apparent volume in a maximum floating state of the liquid powders is two times or more than that in none floating state.

23. The method of manufacturing the image display device according to one of claims 19 - 22, wherein a time change of the apparent volume of the liquid powders satisfies the following formula:

$$V_{10}/V_5 > 0.8;$$

here, V_5 indicates the apparent volume (cm^3) of the liquid powders after 5 minutes from the maximum floating state; and V_{10} indicates the apparent volume (cm^3) of the liquid powders after 10 minutes from the maximum floating state.

24. The method of manufacturing the image display device according to one of claims 19 - 23, wherein an average particle diameter d(0.5) of a particle component constituting the liquid powders is 0.1 - 20 μm.

25. The method of manufacturing the image display device according to one of claims 19 - 21, wherein an average particle diameter of the particles is 0.1 - 50 μm.

26. The method of manufacturing the image display device according to one of claims 19 - 21 and 25, wherein a difference between surface charge densities of the two kinds of particles measured by utilizing same carrier and in accordance with a blow-off method is 5 $\mu C/m^2$ - 150 $\mu C/m^2$ in an absolute value.

27. The method of manufacturing the image display device according to one of claims 19 - 21, 25 and 26, wherein the particles are particles in which the maximum surface potential, in the case that the surface of particles is charged by a generation of Corona discharge caused by applying a voltage of 8 KV to a Corona discharge device deployed at a distance of 1 mm from the surface, is 300 V or greater at 0.3 second after the discharge.

28. An image display device characterized in that the improvement is manufactured according to the method of manufacturing the image display device set forth in one of claims 19 - 27.